openreach

SIN 515

Issue 2.8
April 2026

Suppliers' Information Note
For The Openreach Network

Optical Spectrum Access™

Hub and Spoke, Service & Interface Description

Each SIN is the copyright of British Telecommunications plc. Reproduction of the SIN is permitted only in its entirety, to disseminate information on the BT Network within your organisation. You must not edit or amend any SIN or reproduce extracts. You must not remove BT trade marks, notices, headings or copyright markings.

This document does not form a part of any contract with BT customers or suppliers.

Users of this document should not rely solely on the information in this document, but should carry out their own tests to satisfy themselves that terminal equipment will work with the BT network.

BT reserves the right to amend or replace any or all of the information in this document.

BT shall have no liability in contract, tort or otherwise for any loss or damage, howsoever arising from use of, or reliance upon, the information in this document by any person.

Due to technological limitations a very small percentage of customer interfaces may not comply with some of the individual characteristics which may be defined in this document.

Publication of this Suppliers' Information Note does not give or imply any licence to any intellectual property rights belonging to British Telecommunications plc or others. It is your sole responsibility to obtain any licences, permissions or consents which may be necessary if you choose to act on the information supplied in the SIN.
Those BT services marked ® indicates it is a registered trade mark of British Telecommunications plc. Those

BT services marked ™ indicates it is a trade mark of British Telecommunications plc.

This SIN is available in Portable Document Format (pdf) from:
https://www.openreach.co.uk/orpg/home/helpandsupport/sins/sins.do

Enquiries relating to this document should be directed to: orsinsfa@openreach.co.uk

Issued by: Steve Gray | **Issue:** 2.8 | **Date:** 13/04/2026

Openreach logo are trademarks of British Telecommunications plc. © British Telecommunications plc 2026.

Contents

2. Service Outline for FSP3000 based Hub and Spoke OSA services 3
  2.1 Spoke Bearer types offered on Optical Spectrum Access Hub and Spoke 4
  2.2 Bearer types offered on Optical Spectrum Access Aggregated Hub and Spoke 11
3. GENERAL SERVICE OUTLINE FOR HUB AND SPOKE BASED OSA SERVICES 15
  3.1 NTE vendor 15
  3.2 Services supported on the OSA Hub and Spoke FSP3000 15
  3.3 Spoke Circuit protection 16
4. Customer Interface 17
  4.1 General 17
  4.2 Transparency and Error propagation 22
  4.3 Fibre 23
  4.4 Client Side Optics 23
5. NTE Power Requirements 24
6. FSP3000 NTE Cooling Requirements 24
7. Applications 25
8. Further Information 25
9. References 25
10. Abbreviations 26
11. History 21

TABLES

TABLE 1. FSP3000 Customer Interface Options	21
TABLE 2 Multimode Cable Operating Distances	23
TABLE 3. Optical power margins	23
TABLE 4. Power Fuse ratings	24

1. Introduction

This Suppliers' Information Note (SIN) describes the Openreach Hub and Spoke Optical Spectrum Access (OSA) service and its interfaces.
Optical Spectrum Access (OSA) is an Openreach product within the Optical Spectrum Services portfolio.

OSA Hub and Spoke architecture does not support OSA Filter Connect. Refer to SIN489 for information on OSA Filter Connect.
This document should be read in conjunction with the OSA Product Description available on the Openreach portal
https://www.openreach.co.uk/orpg/home/products/opticalservices/opticalservices.do

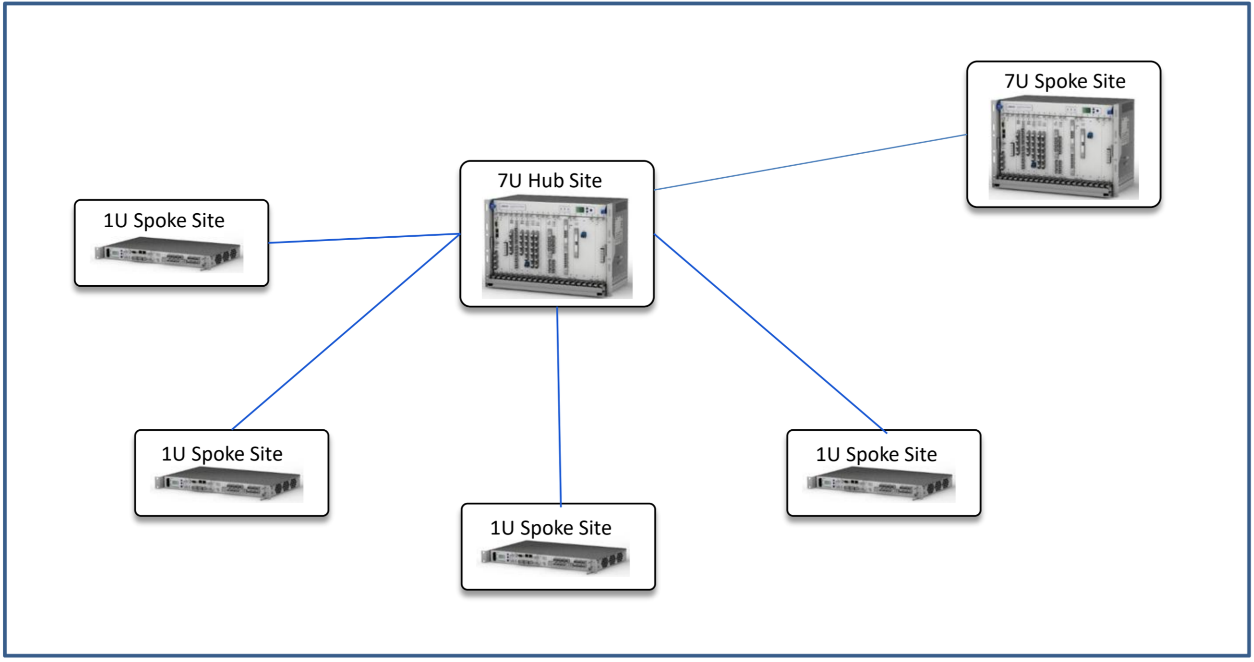
Please note that

1) from 1 June 2022, OSA FSP3000 Resilience Option 1 is not available for new orders. All other OSA FSP3000 Hub & Spoke products are unaffected by this stop sell. Openreach briefing ETH014/22 refers.
2) from 1 June 2023, the 2WCC-PCN-10G, 2TWCC-PCN-2G7UB, 2WCA-PCN-10G and 5TCE-PCN-10GU+10G wavelength cards are not available for new orders. Openreach briefing ETH009/23 refers.
3) From 1 April 2025, all OSA FSP3000 Hub and Spoke options are withdrawn from new supply. Openreach briefing ETH031/24 refers.

2. Service Outline for FSP3000 based Hub and Spoke OSA services

Basic Hub and Spoke schematic

Hub and Spoke Schematic

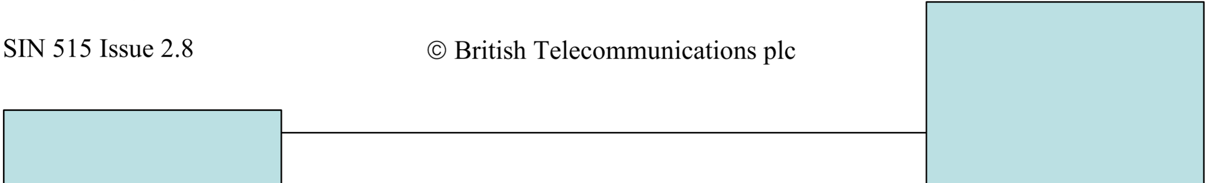


- A Hub can be either a 7U or 1U standard Chassis
- A spoke can be either a 1U Single, 1U Standard or 7U Chassis.
- Hub is scalable to maximum of 4 chassis.
- No restriction on wavelengths (dependent on number of slots available on the Hub/s).
- Each 1U standard spoke has an associated 4Ch filter taking a slot in the Hub.
- RO2 resilient option available on any pair of spokes
- No rules as to number of Wavelengths on a Spoke (other than product limit per bearer).
- Wavelengths can only route over one Spoke Bearer
- No resilient options on wavelengths, only available at the higher Bearer level

2.1 Spoke Bearer types offered on Optical Spectrum Access Hub and Spoke

Customers will be allowed to order the following OSA Spoke bearer type options:

a. 1U Single spoke bearer



1U Single

1U Spoke

7U Hub
Hub

For this configuration, the term "single" is used to indicate that 1U high FSP3000 shelves are deployed without DWDM filters and will only support a single channel.

Customers can choose either an AC or DC powered 1U chassis for each end of a link.

Card and channel growth

Channel growth beyond a single wavelength will require the 1U single spoke bearer type to be converted to a 1U standard spoke type bearer via a modify order to support up to 4 wavelengths. Similarly, channel growth beyond 4 wavelengths will require conversion to a 7U standard bearer via a modify order. Please note any upgrades from 1U single to 1U Standard or 7U Standard or resilience service will be service effecting upgrade.

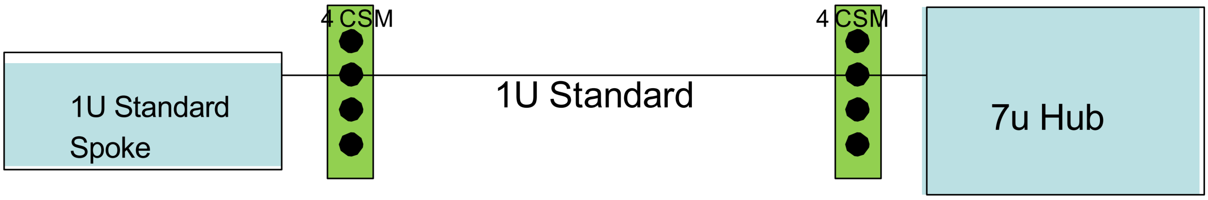
1U single bearer deployments will be limited to fibre route distances that will allow upgrade to 1U standard supporting growth to 4 wavelengths and 7U standard bearers supporting growth to 31/32 wavelengths. Any changes in the bearer type including the addition of an 8GSM filter to a bearer will be expected to require downtime.

Protection Options

RO1 protection will not be supported on this spoke bearer option, though RO2 is supported via an RO2 variant of the 1U single spoke bearer (OSA 1U RO2 No Filter). RO1 resilience** will require an upgrade to the 7U RO1 spoke bearer option, though confirmation that it will be possible to upgrade to RO1, will be subject to survey based on planning rules based on the bearer fibre route distance and transponder card types used on the bearer.

** *RO1 unavailable for new supply after 1 June 2022.*

b. 1U standard Spoke bearer



A single 4-channel filter (4CSM) is fitted as standard to this spoke bearer, therefore this service will support (non-traffic affecting) channel growth to 4 wavelengths.

Customers can choose either an AC or DC powered 1U or 7U chassis (7U chassis only valid for subsequent chassis) for each end of a bearer link. However the AC/DC option used for Chassis at end of a bearer, must be consistent. The mixing of AC and DC chassis at the A- end of a bearer (for example) is not permitted.

Card and channel growth

Channel growth beyond 4 wavelengths will require the 1U standard spoke bearer to be upgraded to a 7U standard Spoke bearer via a modify order for the bearer as well as customer to order the 8GSM filter card. This bearer upgrade is traffic affecting, therefore any customer expecting growth beyond 4 wavelengths is encouraged to choose the 7U bearer option with 8 band filter card fitted to allow non-traffic affecting growth.

1U standard deployments are limited to fibre route distances that will allow upgrade to 7U standard bearers supporting growth to 31/32 wavelengths. However it will be permissible to add booster amplifier and preamplifier cards during the necessary downtime to compensate for the additional optical loss introduced by the 8 band filter card when growing beyond 4 wavelengths or optical loss introduced by the protection module if converting to 7U RO1** bearer.

If a 7U chassis is ordered as a 'subsequent' chassis, this bearer type will still be classed as a 1U standard spoke bearer, with growth limit of 4 wavelengths. Growth beyond 4 wavelengths will require a modify order to convert the "1U standard" spoke bearer to a 7U standard spoke bearer, with additional order to add the 8 band filter card and any additional amplifier cards. Upgrade to 7U standard bearer will in most cases, be carried out using a Provide and Cease of the chassis with 1U high chassis expected to be recovered. This upgrade will require downtime but will allow RO1** capability (subject to distance limits not being exceeded) and will minimise space requirements for bearers containing a moderate number of wavelengths.

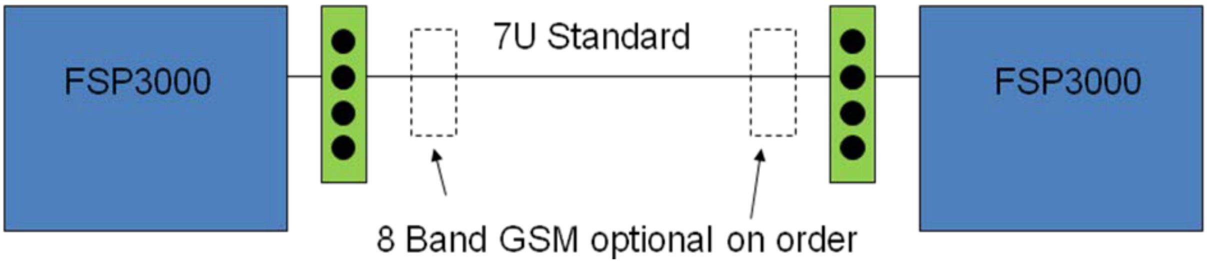
Protection Options

RO1 will not be offered on 1U standard spoke bearers, even if the 1U standard spoke bearer type contains a (subsequent) 7U high chassis, though RO2 resilience is supported as a 1U RO2 bearer option.

RO1** resilience will require an upgrade to the 7U RO1 bearer option. Whilst all bearers will be able to upgrade to support 31/32 wavelengths, confirmation that it will be possible to upgrade to RO1** will be subject to survey using planning rules based on fibre route distance and transponder card types used on the bearer.

** *RO1 unavailable for new supply after 1 June 2022.*

c. 7U standard Spoke Bearer



At order stage, customers may opt to have the 8 band filter module (8GSM) pre-deployed for 7U standard, 7U RO2 and 7U RO1** bearer options. These OSA bearers may or may not be pre- deployed with 8 band filter modules. Where the 8GSM filter card is not pre-deployed, only a maximum number of 4 channels can be supported, any capacity increase beyond 4 wavelengths will require downtime in order to fit an 8 band filter module. Where the 8 band filter module is fitted, channel growth to 32 wavelengths can be supported without the need for downtime. Only 31 channels are supported in case of RO1** bearers.

Customers can choose either an AC or DC powered 7U chassis for each end of a bearer link. However the AC/DC option used for Chassis at end of a bearer must be consistent. The mixing of AC and DC chassis at the A-end of a bearer (for example) is not permitted.

Card and channel growth

Channel growth beyond 4 wavelengths will require the 7U standard bearer to contain an 8 band filter card. This bearer upgrade is traffic affecting, and in some cases will require additional amplifier cards to be added to compensate for additional loss introduced by the 8 band filter card particularly on longer links. Any customer expecting growth beyond 4 wavelengths should be encouraged to choose the 7U bearer option with 8GSM card fitted on initial order.

7U standard bearers may only be deployed over fibre route distances that will allow upgrade to 31/32 wavelengths. However it will be permissible to add post and pre-amplifier cards during the necessary downtime to compensate for the additional optical loss introduced by the 8 band filter card when growing beyond 4 wavelengths or optical loss introduced by the VSM protection module if converting to 7U RO1** bearer.

Protection Options

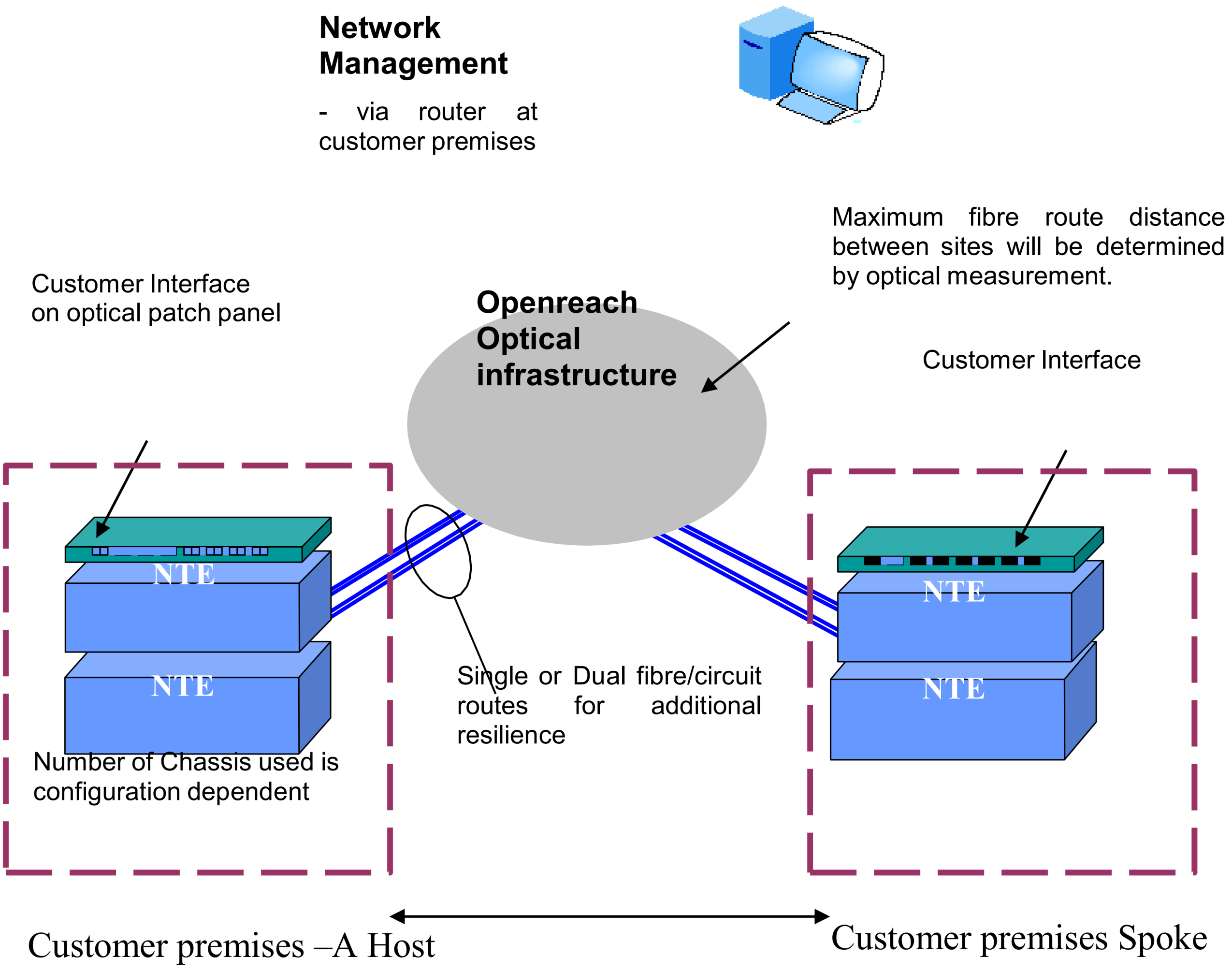
The 7U standard bearer is the only OSA bearer option that has a variant that supports RO1[**] protection (7U RO1), however the upgrade from 7U standard bearer to 7U RO1 bearer will be traffic affecting and as a result requires downtime. Confirmation that it will be possible to upgrade a 7U standard bearer to 7U RO1[**] bearer, will be subject to survey using planning rules based on fibre route distance and transponder card types used on the bearer.

[**] *RO1 unavailable for new supply after 1 June 2022.*

As with the other bearer options, an RO2 variant can be ordered (7U RO2 bearer) by the customer.

Downgrade of bearers types are not supported as part of the OSA service, this will not affect the ability to raise cease orders for wavelengths that are no longer required.

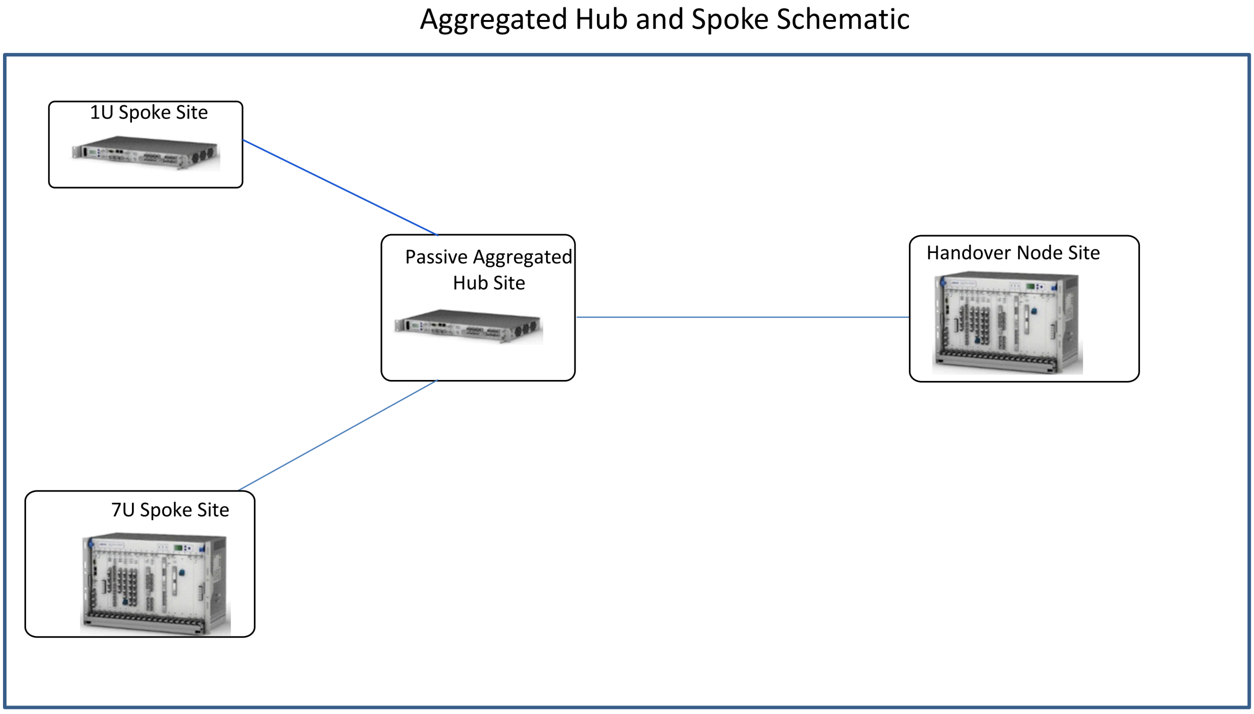
A typical FSP3000 OSA service configuration is shown below in Figure 1.


Network Management
- via router at customer premises
Maximum fibre route distance between sites will be determined by optical measurement.
Customer Interface on optical patch panel
Openreach Optical infrastructure
Customer Interface
NTE
NTE
NTE
NTE
Single or Dual fibre/circuit routes for additional resilience
Number of Chassis used is configuration dependent
Customer premises –A Host
Customer premises Spoke

The Maximum distance supported on FSP 3000 will be dependent on fibre route distance and card/filter configuration.

Figure 1 Typical FSP3000 OSA service configuration

Aggregated Hub and Spoke schematic


Aggregated Hub and Spoke Schematic
1U Spoke Site
Passive Aggregated Hub Site
Handover Node Site
7U Spoke Site

- The Passive Aggregated Hub consists of a 1U passive chassis containing a 8GSM (band splitter) card and associated patch panels and cable management.
- A spoke can be either a 1U Standard or 7U Standard
- The Passive Aggregation Hub will support a maximum of 8 spokes.
- RO1 resilient option is not supported on Aggregated Hub and Spoke
- Each 1U and 7U standard spoke has an associated 4Ch filter taking a slot in the Hub.
- RO2 resilient option available on any pair of spokes
- A maximum of 4 wavelengths are supported on a Spoke
- Wavelengths can only be routed between the spoke site and Handover Node.
- No resilient options on wavelengths, only available at the higher Bearer level
- The bearer between the Passive Aggregation Hub and the Handover Node carries a maximum capacity of 32 wavelengths (4 wavelengths per spoke).
- The bearer between the Passive Aggregation Hub carries all wavelengths

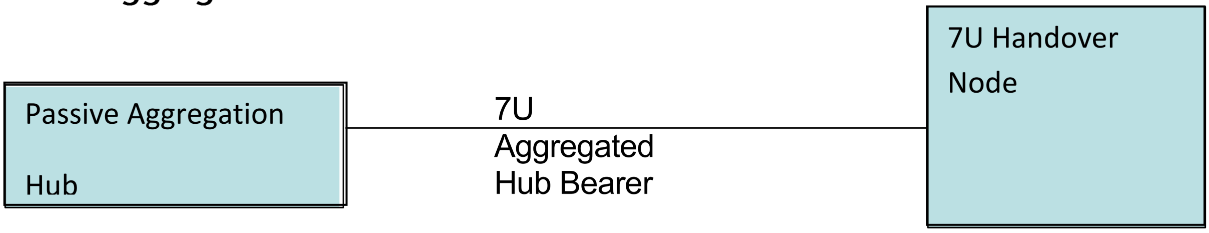
between spoke sites and the handover node, and thus represents a single point of failure.

- The maximum route distance allowed between the Passive Aggregated Hub Site and Handover Node is 60km.
- Distance rules are the same as for existing point to point (and Basic Hub and Spoke) bearers, however when maximum reach is calculated, the total fibre distance between the spoke site and handover site needs to be taken into account.
- Each spoke can be deployed either without amplification or with pre-amplifiers depending on choice of transponders and maximum route distance between spoke sites and handover node.

2.2 Bearer types offered on Optical Spectrum Access Aggregated Hub and Spoke

Customers will be allowed to order the following OSA bearer type options:

a. 7U Aggregated Hub bearer



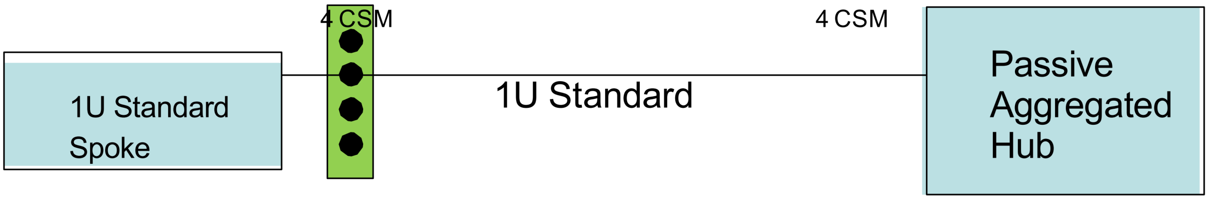
Each Aggregated Hub and Spoke structure, must contain a 7U Aggregated Hub Bearer.

Customers can choose either an AC or DC powered 7U chassis for the handover node. The Passive Aggregation Node does not require electrical power to operate.

Protection Options

RO1 protection will not be supported on this bearer option, though RO2 is supported via an RO2 variant of the 7U Aggregated Hub Bearer (RO2 7U Aggregated BEARER).

b. 1U standard Spoke bearer


4 CSM
4 CSM
1U Standard Spoke
1U Standard
Passive Aggregated Hub

A single 4-channel filter (4CSM) is fitted as standard to this spoke bearer, therefore this service will support (non-traffic affecting) channel growth to 4 wavelengths.

Customers can choose either an AC or DC powered 1U or 7U chassis (7U chassis only valid for subsequent chassis) for each end of a bearer link. However the AC/DC option used for Chassis at end of a bearer, must be consistent. The mixing of AC and DC chassis at the A- end of a bearer (for example) is not permitted.

Card and channel growth

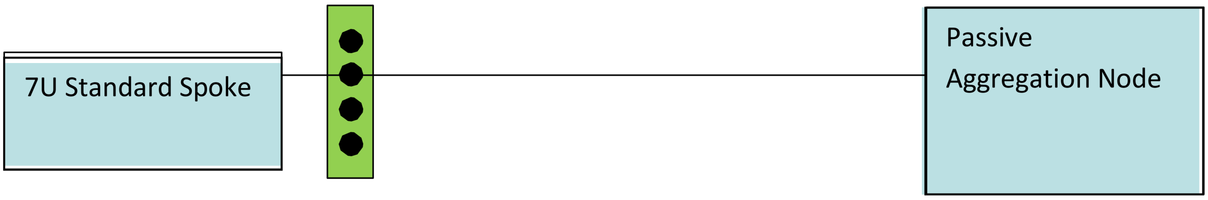
Channel growth beyond 4 wavelengths is not supported.

If a 7U chassis is ordered as a 'subsequent' chassis, this bearer type will still be classed as a 1U standard spoke bearer, with growth limit of 4 wavelengths. Upgrade to 7U standard bearer will in most cases, be carried out using a Provide and Cease of the chassis with 1U high chassis expected to be recovered. This upgrade will require downtime.

Protection Options

RO1 will not be offered on 1U standard spoke bearers, though RO2 protection can be ordered against another bearer (RO2 1U STANDARD BEARER).

c. 7U standard Spoke Bearer



Customers can choose either an AC or DC powered 7U chassis for each end of a bearer link. However the AC/DC option used for Chassis at end of a bearer must be consistent. The mixing of AC and DC chassis at the A-end of a bearer (for example) is not permitted.

Card and channel growth

Channel growth beyond 4 wavelengths is not supported.

Protection Options

RO1 will not be offered on 7U standard spoke bearers, though RO2 protection can be ordered against another bearer (RO2 7U STANDARD BEARER).

A typical FSP3000 OSA service configuration is shown below in Figure 1.

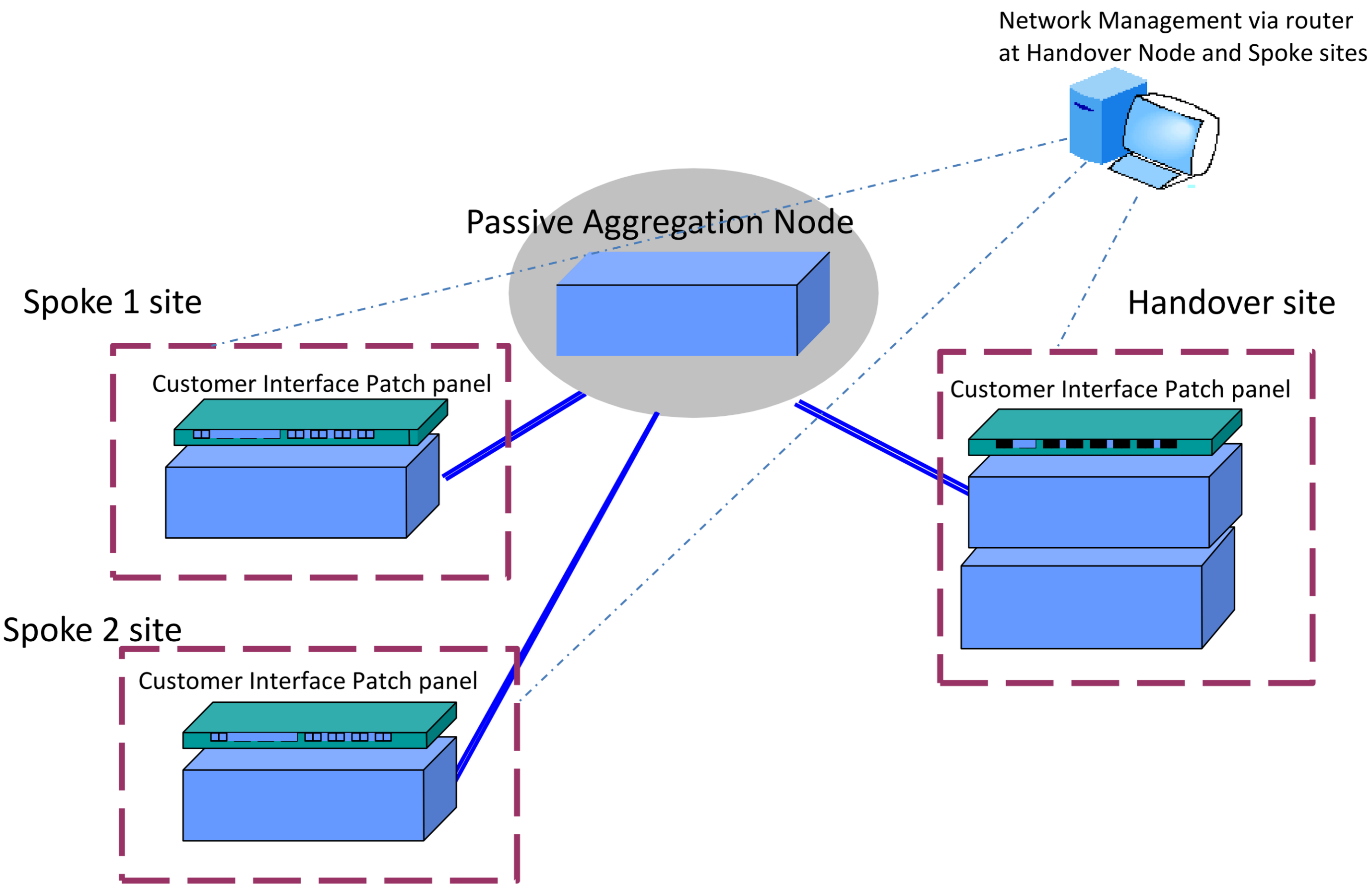

Network Management via router at Handover Node and Spoke sites
Passive Aggregation Node
Spoke 1 site
Customer Interface Patch panel
Handover site
Customer Interface Patch panel
Spoke 2 site
Customer Interface Patch panel

Figure 1 Typical FSP3000 OSA Aggregated Hub and Spoke configuration

3. GENERAL SERVICE OUTLINE FOR HUB AND SPOKE BASED OSA SERVICES

3.1 NTE vendor

The Network Terminating Equipment (NTE) types currently used for Optical Spectrum Hub and Spoke access service, are ADVA FSP3000.

ADVA offers a choice of service interface cards. Please refer to the Optical Spectrum Access product handbook for further information

http://www.openreach.co.uk/orpg/home/products/opticalservices/opticalservices.do

3.2 Services supported on the OSA Hub and Spoke FSP3000

The service allows the point to point transport of the following services between customer sites: -

- STM-64 (9.9532 Gbit/s)
- STM-16 (2.488 Gbit/s) **
- STM-4 (622 Mbit/s) *
- STM-1 (155 Mbit/s) *
- Gigabit Ethernet (1.25 Gbit/s)**
- 10Gbit/s Ethernet LAN PHY (10.3125 Gbit/s)
- 10Gbit/s Ethernet WAN PHY (9.9532 Gbit/s)
- Fibre Channel/FICON 1Gbit/s FC100 (1.062 Gbit/s)**
- Fibre Channel/FICON 2Gbit/s FC200 (2.125 Gbit/s)**
- Fibre Channel/FICON 4Gbit/s FC400 (4.25Gbit/s)**
- Fibre Channel/FICON 8Gbit/s FC800 (8.50Gbit/s)
- Fibre Channel/FICON 10Gbit/s FC1200 (10.52Gbit/s)**
- G.709 OTU2 (10.709 Gbit/s)
- G.709 OTU1 (2.666 Gbit/s)**
- ISC-3 Peer Mode (2.125Gbit/s) **

Optical Spectrum Access services are intended for connection to standard optical interfaces of 850nm multimode or 1310nm single-mode/multimode types. No electrical interfaces are offered. Table 1 gives details of the optical interface/service options for FSP3000.

* Unavailable for new supply after 5 July 2021

** Unavailable for new supply after 1 June 2023

3.3 Spoke Circuit protection

This service is offered on a point-to-point basis with optionally no fibre circuit protection (Standard), or with Resilience Option 1[**] or Resilience Option 2 protection options.

- **Standard** consists of a single OSA Spoke Bearer between the circuit A-end and B-end addresses with no standby circuit or path. In the event of a fibre failure service may be lost. It is recommended that a back-up service is available.
- **Resilience Option 1 (RO1)**[**] consists of a single OSA Spoke Bearer between the same circuit A-end and B-end addresses with two diversely routed fibre paths. In the event of a problem occurring on the primary route, traffic will be automatically switched to the secondary fibre path. The protection is performed on the fibre link carrying the multiplexed wavelengths. Protection is not provided on a per optical channel basis. Only available on Basic Hub solutions. *** RO1 unavailable for new supply after 1 June 2022*
- **Resilience Option 2 (RO2)** consists of two individual OSA Spoke Bearers delivered using diversely routed fibres between the same circuit A-end and B-end addresses, or between the same A-end and different B-end addresses. Customers are free to use each bearer as they wish. It is the customers' responsibility to ensure that the traffic carrying capacity of the wavelengths is sufficient to support the resilience of their service in the event of failure. Note that the two OSA bearers in an RO2 configuration do not perform an automatic protection switching. If protection switching is required this will need to be supplied by the CP.

The maximum permitted fibre route distance will vary depending on the vendor, wavelength speed and resilience option used. Refer to the OSA Product Handbook for further information on bearer resilience options and distance limitations:

http://www.openreach.co.uk/orpg/home/products/opticalservices/opticalservices.do

Protocols with latency sensitivities may require customer reconfiguration following an incident resulting in a switch to the protection path. The Openreach equipment will continue to function on the protection path.

4. Customer Interface

4.1 General

The patch panel interface, where used is the Network Termination Point (NTP), i.e. the point of connection between the Openreach Network Terminating Equipment (NTE) and the CPE interface.

Customer interfaces that will be offered are presented via an optical patch panel or directly on the NTE using Dual LC interfaces. Either a single duplex or a pair of simplex LC cables may be used, though duplex cables with dual LC connectors will ensure that transmit and receive connections are correctly made the right way round.

Single-mode (1310nm) or multimode (850nm) interface options are available depending on the type of wavelength card selected. The NTE vendor offers a choice of wavelength interface cards, however there may be differences in the number and types of interfaces supported per card.

Service	**Card type**	**Transparency**	**Client Port Options** Pluggable type / maximum speed / wavelength /Single-Mode(SM) or Multimode (MM) / connector type	**Client port Error signal**
10G Fibre Channel	5TCE-PCTN-10GU+10G *	PCS layer	SFP+/10G/1310S/SM/LC or SFP+/11GU/850I/MM/LC	Loss of Signal
	2WCA-PCN-10G *	Physical layer	XFP/11G/1310S/SM/LC or XFP/10G/850I/MM/LC	Loss of Signal
	5TCE-PCTN-10GU+AES10G *	PCS layer	SFP+/11GU/1310S/SM/LC or SFP+/11GU/850I/MM/LC	Loss of Signal
10G LAN PHY	WCC-PCTN-10G *	PCS Layer	XFP/11G/1310S/SM/LC	Local Fault as per IEEE802.3
	2WCC-PCN-10G *	PCS Layer	XFP/11G/1310S/SM/LC	Local Fault as per IEEE802.3
	4WCC-PCN-10G	PCS Layer	SFP+/11GU/1310S/SM/LC or SFP+/11GU/850I/MM/LC	Local Fault as per IEEE802.3
	5TCE-PCTN-10GU+10G *	PCS layer	SFP+/10G/1310S/SM/LC or SFP+/11GU/850I/MM/LC	Loss of Signal
	2WCA-PCN-10G *	Physical layer	XFP/11G/1310S/SM/LC or XFP/10G/850I/MM/LC	Loss of Signal
	5WCA-PCN-16GU	Physical layer	SFP+/11GU/1310S/SM/LC or SFP+/11GU/850I/MM/LC	Loss of Signal

	5TCE-PCTN-10GU+AES10G *	PCS layer	SFP+/11GU/1310S/SM/LC or SFP+/11GU/850I/MM/LC	Loss of Signal
10G WAN PHY	WCC-PCTN-10G *	client signal not modified	XFP/11G/1310S/SM/LC	MS-AIS (ITU-T G.783)
	2WCC-PCN-10G *	client signal not modified	XFP/11G/1310S/SM/LC	MS-AIS (ITU-T G.783)
	2WCA-PCN-10G *	Physical Layer	XFP/11G/1310S/SM/LC	Loss of Signal
	4WCC-PCN-10G	client signal not modified	SFP+/11GU/1310S/SM/LC or SFP+/11GU/850I/MM/LC	MS-AIS (ITU-T G.783)
OTU2	WCC-PCTN-10G *	ODU2 transparent	XFP/11G/1310S/SM/LC	AIS-ODU
	2WCC-PCN-10G *	ODU2 transparent (OTU GCC0 reserved for Openreach use)	XFP/11G/1310S/SM/LC	AIS-ODU
	4WCC-PCN-10G	ODU2 transparent	SFP+/11GU/1310S/SM/LC or SFP+/11GU/850I/MM/LC	AIS-ODU

	2WCA-PCN-10G *	Fully transparent	XFP/11G/1310S/SM/LC	Loss of Signal (Laser off)
8G Fibre Channel	5TCE-PCTN-10GU+10G *	PCS Layer	SFP+/10G/1310S/SM/LC or SFP+/11GU/850I/MM/LC	Loss of Signal
	2WCC-PCN-10G *	PCS layer	XFP/8G/1310S/SM/LC	Non-valid line code as per ITU-T G.7041
	2WCA-PCN-10G *	Physical layer	XFP/8G/1310S/SM/LC	Loss of Signal
	5WCA-PCN-16GU	Physical layer	SFP+/11GU/1310S/SM/LC or SFP+/11GU/850I/MM/LC	Loss of Signal
	5TCE-PCTN-10GU+AES10G *	PCS layer	SFP+/11GU/1310S/SM/LC or SFP+/11GU/850I/MM/LC	Loss of Signal
4G Fibre Channel	4TCA-PCN-4GU+4G *	PCS layer	SFP/4GU/850I/MM/LC or SFP/4GU/1310S/SM/LC	Loss of Signal
	5TCE-PCTN-10GU+10G *	PCS Layer	SFP/4GU/850I/MM/LC or SFP/4GU/1310S/SM/LC	Loss of Signal
	10TCC-PCTN-4GUS+10G *	PCS layer	SFP/4GU/850I/MM/LC or SFP/4GU/1310S/SM/LC	Non-valid line code as per ITU-T G.7041

	2WCA-PCN-10G *	Physical layer	XFP/8G/1310S/SM/LC	Loss of Signal
	5TCE-PCTN-10GU+AES10G *	PCS Layer	SFP/4GU/850I/MM/LC or SFP/4GU/1310S/SM/LC	Loss of Signal
2G Fibre Channel	4TCA-PCN-4GU+4G *	PCS layer	SFP/2G1/850I/MM/LC or SFP/2G5U/1310S/SM/LC	Non-valid line code as per ITU-T G.7041
	5TCE-PCTN-10GU+10G *	PCS layer	SFP/2G1/850I/MM/LC or SFP/2G5U/1310S/SM/LC	Loss of Signal
	10TCC-PCTN-4GUS+10G *	PCS layer	SFP/2G1/850I/MM/LC or SFP/2G5U/1310S/SM/LC	Non-valid line code as per ITU-T G.7041
	2TWCC-PCN-2G7U *	Physical layer	SFP/2G1/850I/MM/LC or SFP/2G5U/1310S/SM/LC	Loss of Signal
	5TCE-PCTN-10GU+AES10G *	PCS layer	SFP/2G1/850I/MM/LC or SFP/2G5U/1310S/SM/LC	Loss of Signal
1G Fibre Channel	4TCA-PCN-4GU+4G *	PCS layer	SFP/2G1/850I/MM/LC or SFP/2G5U/1310S/SM/LC	Non-valid line code as per ITU-T G.7041
	5TCE-PCTN-10GU+10G *	PCS Layer	SFP/2G1/850I/MM/LC or SFP/2G5U/1310S/SM/LC	Loss of Signal
	10TCC-PCTN-4GUS+10G *	PCS layer	SFP/2G1/850I/MM/LC or SFP/2G5U/1310S/SM/LC	Non-valid line code as per ITU-T
	5TCE-PCTN-10GU+AES10G *	PCS Layer	SFP/2G1/850I/MM/LC or SFP/2G5U/1310S/SM/LC	Loss of Signal

	2TWCC-PCN-2G7U	Physical layer	SFP/2G1/850I/MM/LC or SFP/2G5U/1310S/SM/LC	Loss of Signal
Gigabit Ethernet	4TCA-PCN-4GU+4G *	PCS layer	SFP/2G1/850I/MM/LC or SFP/2G5U/1310S/SM/LC	K30.7 (8B/10B code word) as per ITU-T G.7041 and IEEE802.3
	4TCA-PCN-4GUS+4G *	PCS layer	SFP/2G1/850I/MM/LC or SFP/2G5U/1310S/SM/LC	K30.7 (8B/10B code word) as per ITU-T G.7041 and IEEE802.3
	5TCE-PCTN-10GU+10G *	PCS Layer	SFP/2G1/850I/MM/LC or SFP/2G5U/1310S/SM/LC	Loss of Signal
	5TCE-PCTN-10GU+AES10G *	PCS layer	SFP/2G1/850I/MM/LC or SFP/2G5U/1310S/SM/LC	Loss of Signal
	10TCC-PCTN-4GUS+10G *	PCS layer	SFP/2G1/850I/MM/LC or SFP/2G5U/1310S/SM/LC	Default setting: K30.7 (8B/10B code word) as per ITU-T G.7041 and IEEE802.3. Alternatively, Loss of Signal can be requested on CRF
	2TWCC-PCN-2G7U *	PCS layer	SFP/2G1/850I/MM/LC or SFP/2G5U/1310S/SM/LC	K30.7 (8B/10B code word) as per ITU-T G.7041 and IEEE802.3
STM-4	4TCA-PCN-4GUS+4G *	client signal not modified	SFP/2G5U/1310S/SM/LC	Loss of Signal
	WCC-PC1N-2G7U *	client signal not modified	SFP/2G5U/1310S/SM/LC	MS-AIS
	10TCC-PCTN-4GUS+10G *	client signal not modified	SFP/2G5U/1310S/SM/LC	Loss of Signal
STM-1	4TCA-PCN-4GUS+4G *	client signal not modified	SFP/2G5U/1310S/SM/LC	Loss of Signal
	WCC-PC1N-2G7U *	client signal not modified	SFP/2G5U/1310S/SM/LC	MS-AIS
	10TCC-PCTN-4GUS+10G *	client signal not modified	SFP/2G5U/1310S/SM/LC	Loss of Signal
STM-16	WCC-PC1N-2G7U *	client signal not modified	SFP/2G5U/1310S/SM/LC	MS-AIS
	10TCC-PCTN-4GUS+10G *	client signal not modified	SFP/2G5U/1310S/SM/LC	Loss of Signal

	2TWCC-PCN-2G7U *	client signal not modified	SFP/2G5U/1310S/SM/LC	MS-AIS
ISC-3 Peer Mode (2.125G)	5TCE-PCTN-10GU+10G *	PCS layer	SFP/2G1/850I/MM/LC or SFP/2G5U/1310S/SM/LC	Loss of Signal
	5TCE-PCTN-10GU+AES10G *	PCS layer	SFP/2G1/850I/MM/LC or SFP/2G5U/1310S/SM/LC	Loss of Signal
OTU1	WCC-PC1N-2G7U *	ODU1 transparent	SFP/2G5U/1310S/SM/LC	AIS-ODU
	2TWCC-PCN-2G7U *	ODU1 transparent	SFP/2G5U/1310S/SM/LC	AIS-ODU

Table 1. FSP3000 Customer Interface options

* Card unavailable for new supply

4.2 Transparency and Error propagation

The OSA service is designed to provide as much transparency as possible. OTN and SDH overhead bytes are not modified by the service. PCS layer transparency allows not only Ethernet and Fibre Channel bytes to be transported, but also the IFG (also known as IPG) to be transported. Physical layer transparency description in the Table 2 is used to indicate that transport is at the binary level. As transport of Ethernet occurs below layer 2, (at line code/PCS level or physical layer), layer 2 Ethernet control protocols are transported transparently.

Transport of Fibre Channel frame sizes greater than 2148 bytes, and Ethernet frame sizes greater than 9600 bytes, is not supported.

In the event of a failure of a client input at one end of the link, an error signal will be propagated to the far end client port. In the event of a wavelength / bearer failure, an error signal will be generated on the NTE's client port at both ends of a link. In most cases this error propagation signal will be an International Standards defined error signal for some cards, for other cards this will be a laser off/Loss of Signal condition.

It is strongly advised that interconnecting equipment with Loss of Signal error propagation behaviour is avoided as this scenario will greatly complicate the re-establishment of end to end connectivity.

4.3 Fibre

For services employing a single-mode interface, all fibre optic connections to and from the patch panel will use single-mode fibre 9/125 micron according to ITU-T G.652.

For services employing a multimode interface, all fibre optic connections to and from the patch panel will use multimode fibre 62.5/125 micron or 50/125 micron according to ITU-T G.651.

The maximum distances supported on 8G/10G multimode interfaces is dependent on the bandwidth specification of the multimode cable provided by the customer. Maximum 10G distances for various multimode cables types are provided in table 2. Distances for 8G interfaces are expected to be broadly similar.

Multimode fibre type	**Multimode cable modal bandwidth (MHz•km)**	**Operating Distance (m)**
FDDI	160	26
OM-1	200	33
OM-2	400	66
OM-3	500	82
OM-4	2000	300

Table 2. Multimode cable operating distances

4.4 Client Side Optics

Table 3 provides details of the Optical power margins for both the Receive and Transmit interfaces of the client facing optical interfaces. Please note that the CP may be responsible for damage caused by exceeding the optical parameters listed.

ADVA		
Customer interface type	**Valid Input Range**	**Expected Output from interface**
XFP/10G/850I/MM/LC	-8.0dBm to -2dBm	-8.0dBm to -1dBm
SFP+/11GU/1310S/SM/LC	-12.0dBm to -2dBm	-6.0dBm to 0dBm
SFP+/11GU/850I/MM/LC	-10.0dBm to 0dBm	-8.0dBm to -1dBm
SFP+/10G/1310S/SM/LC	-13.0dBm to -1.0dBm	-8.0dBm to -0.5dBm
XFP/11G/1310S/SM/LC	-12.0dBm to -2.0dBm	-6.0dBm to -1.0dBm
XFP/8G/1310S/SM/LC	-9.0dBm to -0.5dBm	-6.0dBm to -1.0dBm
SFP/4GU/850I/MM/LC	-13.0dBm to -1.0dBm	-10.0dBm to -2.5dBm
SFP/4GU/1310S/SM/LC	-14.0dBm to -2.0dBm	-9.0dBm to -1.0dBm
SFP/2G1/850I/MM/LC	-14.0dBm to -4.0dBm	-10.0dBm to -3.0dBm
SFP/2G5U/1310S/SM/LC	-17.0dBm to -1.0dBm	-5.0dBm to 0.0dBm

Table 3. Optical power margins

5. NTE Power Requirements

The NTE will require two 240 Volt AC power supplies using 13 Amp switched sockets.

If the customer wishes the NTE to be powered from a 48V DC supply, it is the customer's responsibility to provide and maintain this supply.

In addition to the NTE power requirements a 50Hz AC mains supply 13amp socket should also be provided, in close proximity to the NTEs, to power Openreach test equipment during both initial commissioning and subsequent maintenance support activities.

Table 4 Fuse ratings

Chassis Type	Power	Power feeds per chassis	Fuse per power feed (Amps)	Power Cable Termination
7U	AC	2	10A	BS1363 plug
7U	DC	2	20A	Cable termination
1U	AC	2	5A	BS1363 plug
1U	DC	2	6A	Molex Connector

It is mandatory for CP's to read the AC/DC Power planning and Installation Guide which can be downloaded from:-

https://www.openreach.co.uk/orpg/customerzone/products/opticalservices/opticalspectrumaccess/description/supplementaryinformation/osaproductdescription.do

6. FSP3000 NTE Cooling Requirements

The maximum power consumption figure for FSP3000 7U chassis when fully loaded is 540W, and for a fully loaded 1U chassis the power consumption figure is 140W.

Where high density deployments of FSP3000 chassis are expected, the environmental cooling must be assessed to ensure that is sufficient sized for such deployments. For this reason, it is not recommended to house more than three 7U high FSP3000 chassis or twelve 1U high FSP3000 chassis in one cabinet, or indeed any combination of equipment, with power consumption exceeding more than 1800W.

7. Applications

ESCON, FICON and Coupling Link are proprietary storage area protocols from IBM, and are used in many SAN customer sites. ESCON is not supported on the FSP3000. Currently only the ISC-3 peer mode (2.125Gbit/s) variant of Coupling Link is supported on FSP3000.

8. Further Information

For enquiries concerning connection availability between particular sites and for further product information about this service please visit the website at www.openreach.co.uk or contact your Openreach Customer Business Manager or BT Account Manager.

If you have enquiries relating to this document, then please contact:

orsinsfa@openreach.co.uk

9. References

ITU-T G.651	Recommendation G.651 (02/98) – Characteristics of a 50/125 µm multimode graded index optical fibre cable
ITU-T G.7041	Recommendation G.7041/Y.1303 – Generic Framing
IEEE 802.3	IEEE Standard for Information technology-Telecommunications and information exchange between systems-Local and metropolitan area networks-Specific requirements Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical
ITU-T G.652	Recommendation G.652 (04/97) – Characteristics of a single-mode optical fibre cable
Gigabit	IEEE 802.3z or SIN 360 Gigabit Ethernet for the BT Network
Fibre Channel	ANSI/NCITS X3.288-1996 or SIN 345 Channel Extension
2G Fibre Channel	Fibre Channel Physical interface (FC-PI), ANSI 212-642-4900 ANSI INCITS 352-2002
ESCON, FICON, FICON Express, Coupling Link,	IBM Proprietary as specified in IBM Red Book Standard for GDPS.

10. Abbreviations

4CSM	4 Channel Splitter module
AC	Alternating Current
ANSI	American National Standards Institute
ASI	Asynchronous Serial Interface
ATM	Asynchronous Transfer Mode
CPE	Customer Premises Equipment
DC	Direct Current
DWDM	Dense Wavelength Division Multiplexing
ESCON	Enterprise Systems CONnectivity architecture [IBM]
ETR	External Time Reference
FICON	Fibre CONnectivity
IBM	International Business Machines
IFG	Inter Frame Group
IPG	Inter Packet group
IP	Internet Protocol
ISC	InterSystem Channel (Coupling Link)
ITU-T	International Telecommunication Union - Telecommunications Standardization Sector (formerly CCITT)
LAN	Local Area Network
Mbit/s	Megabits per second
Gbit/s	Gigabits per second
GDPS	Geographically Dispersed Parallel Sysplex [IBM]
MUX	Multiplexer
NCITS	National Committee for Information Technology Standards
NTE	Network Terminating Equipment
NTP	Network Terminating Point
OSA	Optical Spectrum Access
OTN	Optical Transport Network" as described in ITU-T G.709 "Interfaces for the
PCS	Physical Coding Sublayer as described in IEEE 802.3
PHY	Physical Layer

RO1	Resilience Option 1
RO2	Resilience Option 2

SAN	Storage Area Network(s)
SC	Structured Connector
SDH	Synchronous Digital Hierarchy
SIN	Suppliers' Information Note
SONET	Synchronous Optical Network
STM	Synchronous Transport Module
VSM	Versatile Switch Module
WAN	Wide Area Network

11. History

Issue	Date	Changes
Issue 1.0	April 2015	1st Issue
Issue 2.0	November 2016	inserted text and diagrams for the new OSA Aggregated Hub and Spoke product
Issue 2.1	March 2017	Inclusion of Encryption service card. Inclusion of Multi-mode cable operating
Issue 2.2	April 2018	Updated fuse rating for 7u shelf
Issue 2.3	June 2018	Addition of note in section 1 to clarify that OSA Hub & Spoke does not support OSA Filter
Issue 2.4	July 2020	Openreach branding and links updated
Issue 2.5	September 2021	Updates to Sections 3.2 and Table 1 to reflect withdrawal from new supply of 4TCA-PCN-4GU+4G, 4TCA-PCN-4GUS+4G and 5TCE-PCN-10GU+AES10G wavelength cards.
Issue 2.6	June 2022	Updated to show RO1 unavailable for new supply from 1 June 2022
Issue 2.7	March 2023	Updates to Sections 3.2 and Table 1 to indicate withdrawal from new supply of 2WCC-PCN-10G, 2TWCC-PCN-2G7UB, 5TCE-PCN-10GU+10G and 2WCA-PCN-10G wavelength cards from 1 June 2023. Removal of “OSA FSP3000 Encryption Service” section.
Issue 2.7	July 2024	Annual Review – no changes made – issue number therefore remains the same
Issue 2.8	April 2026	Update ‘Table 1 FSP3000 customer interface options’ to correct OTUx transparency values.

< END >